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THE ORBIT OF ι *ORIONIS*

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THE ORBIT OF ι *ORIONIS*

BY J. S. PLASKETT

Acting on a suggestion kindly made to me by Dr. Schlesinger, a least-squares solution has been applied to the elements of the orbit of ι *Orionis* recently published in this *Journal*.[1] As preliminary elements those determined in the above paper were taken, and the 113 plates were grouped into 26 normal places, the same as before except for some minor changes introduced by a consistent system of weighting. An ephemeris having been computed from these elements, the coefficients of the unknowns in the observation equations were calculated from the formulae of Lehmann-Filhés[2] for each of these places. The period was considered as very closely determined by the method previously used and a correction considered unnecessary.

From the observation equations were formed the normal equations below, the following factors being introduced for homogeneity:

$$x = \delta K$$
$$y = K\delta e = 112\delta e$$
$$z = K\delta\omega = 112\delta\omega$$
$$u = \frac{K\mu}{(1-e^2)^{\frac{3}{2}}}\delta T = 83.46\delta T$$
$$v = \delta\gamma$$

NORMAL EQUATIONS

$$\begin{array}{rrrrrr}
+44.968x & -\ 29.522y & +\ 3.322z & +\ 0.327u & -14.291v & +\ 98.606=0 \\
 & +228.507y & -41.899z & +65.630u & +39.089v & -244.074=0 \\
 & & +51.724z & -53.431u & -33.929v & -\ 33.442=0 \\
 & & & +76.940u & +25.424v & -\ 56.373=0 \\
 & & & & +95.000v & -\ 15.800=0
\end{array}$$

The solution of these equations gave the following corrected elements:

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[1] *Astrophysical Journal*, **27**, 272, 1908.

[2] *Astronomische Nachrichten*, **136**, 17, 1894.

	Preliminary	Corrected
K	112.0	109.92
e	0.75	0.7552
ω	110°	113°.31
T	1.94 days	1.991 days
γ	+20.7 km	+21.34 km
Period	29.136 days	29.136 days
$a \sin i$	29,680,000 km	28,867,000 km

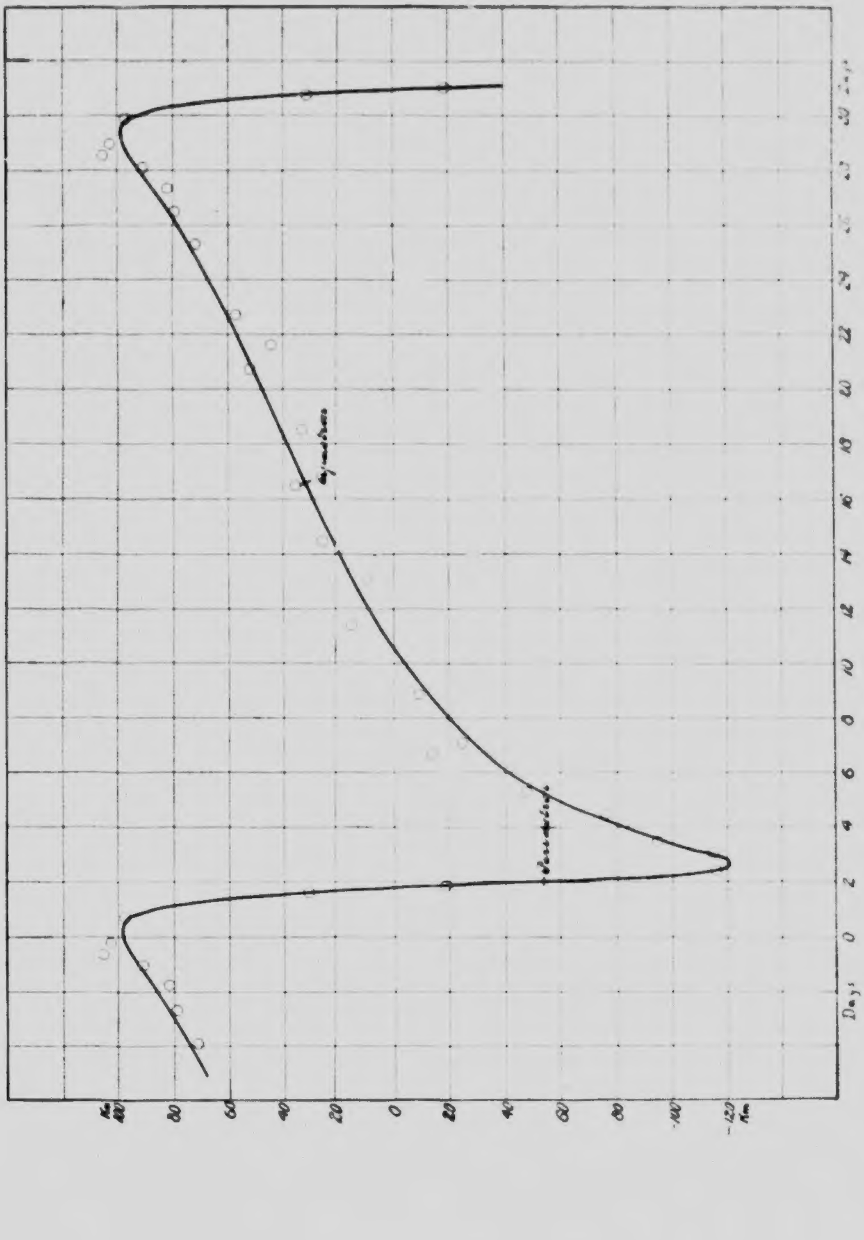
A comparison of the residuals obtained from an ephemeris and from substitution in the observation equations showed some differences of over a kilometer and a second solution was necessary. For preliminary elements those obtained in the first solution, except T, which was increased to 2.01 days, were used. The change in T was due to a better agreement thereby produced in the residuals. Using the same substitutions for homogeneity there result the normal equations

$$\begin{array}{rrrrrr}
+45.058x & -28.047y & +2.576z & +0.726u & -14.660v & -0.\text{[illegible]}1=0 \\
 & +266.994y & -45.686z & +65.208u & +43.697v & +117.\text{[illegible]}2=0 \\
 & & +50.372z & -48.247u & -33.053v & -70.762=0 \\
 & & & +64.085u & +22.897v & +95.820=0 \\
 & & & & +95.000v & +34.800=0
\end{array}$$

Their solution gives for final elements the following:

K	109.90	±1.100 km
e	0.7543	± .0046
ω	113°.28	±1°.083
T	1.993	± .022 days = Julian Day 2,417,587.993
γ	+21.34	±0.856 km
Period	29.136 days	
$a \sin i$	28,907,000 km	

An ephemeris computed from these elements shows that Σpvv has been reduced from 2994 to 2181, the probable error of an observation of unit weight becoming ±6.88 km, while the probable errors of the elements become those given above. The changes from the first solution are very small but the agreement between the residuals is now satisfactory. The velocity-curve corresponding to the final elements is given in the accompanying figure, with the positions of the normal places as small circles. A comparison of



Velocity-Curve of ι Orionis

this with the previous figure shows that the general trend of the observations is more closely followed. The probability of a secondary disturbance seems somewhat less than with the original elements, and this is further lessened by a knowledge of the fact that the normal places with the highest residuals contain always one or more observations with the universal spectroscope where the temperature control was poor and the spectra contained only two measurable lines.

The result of this computation seems to justify Dr. Schlesinger's contention that, even in the case of spectra in which accurate measurement is impossible, the least-squares solution will give the best determination of the elements of a binary orbit.

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